THE EFFECTS OF LOW-DOSE IRRADIATION ON DAPHNIA MAGNA

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In our recent studies the effects of low-dose gamma irradiation on the crustacean *Daphnia magna* have been analyzed. Daphnids represent a very useful experimental model, which allows the very efficient and quick analysis of many aspects of non-targeted effects of ionising radiation, including radiation-induced genomic instability manifesting in the directly exposed animals and their offspring. The life span of these animals is relatively short and seldom exceeds 10-11 weeks; they are also characterised by quite short durations of embryonic development (3-4 days) and gestation (5-8 days). Most importantly, *Daphnia magna* ‘enjoy’ parthenogenetic reproduction, which quickly allows establishing genetically identical strains of these animals. Given that the LD_{50} for this species is approximately 100 Gy, one-day-old Daphnia were exposed to 0.1, 1 and 20 Gy of acute γ-rays. The survival of irradiated animals was evaluated over the period of 30 days. It was found that exposure to the lowest dose of 0.1 Gy significantly decreased the survival of irradiated Daphnia. Most strikingly, the decreased survival of irradiated animals did not show a clear dose-response, thus suggesting that the non-targeted effects, including bystander-like interactions between the exposed Daphnia, may underlie the observed changes. To further verify these results, we have recently analyzed the survival of Daphnia exposed to the lowest dose of 0.1 Gy over the maximum lifespan of 90 days. It was found that the increased mortality among irradiated Daphnia peaked at 30 days after exposure and closely followed the survival rate in controls. Our data also showed that the observed decrease in survival of irradiated animals was attributed to their early aging, thus providing an important evidence for the effects of low-dose irradiation on early senescence. Overall, the results of our studies have shown that low-dose irradiation can result in a significant, up to 35%, reduction in life span of exposed Daphnia. As the majority of irradiated Daphnia showed reduced viability regardless the dose, our data therefore imply the presence of a threshold of dose of low-LET exposure capable of impairing the viability of this species. The results of our previous studies on the effects of γ-irradiation on the ciliate *Spirostomum ambiguum* are in line with the Daphnia data.

In a separate study, we have also analyzed the effects of paternal low-dose irradiation on the offspring of exposed Daphnia. It was found that parental irradiation significantly affected the survival of first-generation offspring, the magnitude of which cannot be attributed to the segregation of radiation-induced deleterious mutations. The transgenerational reduction of life span among the offspring of irradiated parents can therefore be attributed to non-targeted events, similar to those previously described in mammals.

Potential implications of the results of our studies for the risk assessment of low-dose exposure will be discussed.